Contingency Cost estimation for Research reactor Decommissioning

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1. Introduction

Under the current regulation policy, owner of a nuclear facility such as research reactor should get an approval from regulatory body regarding preliminary decommissioning plan for that facility. There are many types of cost items in decommissioning cost estimation, however, contingencies are for unforeseen elements of cost within the defined project scope. Regulatory body wants to reasonable quantification for this issue. Many countries have adopted the breakdown of activity-dependent and period-dependent costs to structure their estimates. Period-dependent costs could be broken down into defined time frames to reduce overall uncertainties. Several countries apply this notion by having different contingency factors for different phases of the project. This study is a compilation of contingency cost of research reactor and for each country.

2. Methods and Results

In this section some of the techniques used to model the detector channel are described. The channel model includes a SiC detector, cable, preamplifier, amplifier, and discriminator models.

2.1 Detector Model

The WEC co-authors of this Transactions have developed designs for the SiC diode detectors that are to be used in the neutron monitoring channel [1,2]. A four-layer configuration of such a diode detector, consisting, the output current is shown as a function of time in Fig. 1, for three particles that have been simulated as interacting in the detector randomly in time, with an average event rate of 10 8 events/s.

Some countries use a defined contingency: Belgium uses 15%, Canada uses a range based on estimate accuracy – a Grade A estimate 10%, Grade B 15-20%, Grade C 30% – the Slovak Republic uses 20-25%, Spain 15%, Sweden 6 20% and the US approximately 25%.Ensuring robust cost estimates in the context of long-term uncertainties may be addressed either by the financing scheme or by including contingency factors in the cost estimate

Contingencies are for unforeseen elements of cost within the defined project scope. Uncertainties are for unforeseeable elements of cost outside the defined project scope (such as currency exchange rate fluctuations, inflation beyond the norm of say 5% and regulatory changes).

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2.3 Preamplifier Model

For our analysis, two major types of preamplifiers (charge sensitive and voltage sensitive) were modeled using MATLAB by supplying their transfer functions in s-space. The transfer function of the voltage sensitive preamplifier was specified based on the manufacturer's published bandwidth characteristics. The transfer function for the charge sensitive preamplifier was calculated based on the published rise time, fall time and sensitivity of the preamplifier.

Estimates of decommissioning costs have been performed and published by many organisations for many different purposes and applications

that have been simulated as interacting in the detector randomly in time, with an average event rate of 108 events/s.

2.4 Shaping Amplifier Model

The output of the charge sensitive preamplifier is an exponentially decaying tail pulse. At relatively high count rates, the large decay time constant of a charge sensitive preamplifier causes severe pulse pile-up, as pulses are superimposed on the tails of the previous pulses [6]. A shaping amplifier is used to reduce pile-up. A bipolar amplifier was modeled in MATLAB as a circuit with two differentiators and an integrator.

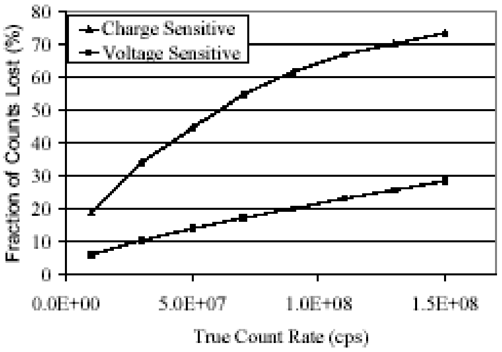

Fig. 2. Fraction of counts lost with voltage and charge sensitive preamplifiers as a function of the true count rate.

Table I: Contingency in total Cost

	Thermal conductivity (W/cm-K)	Radius (cm)
Kernel		
Buffer		
Inner Pyc		
SiC		

2.5 Single Channel Analyzer (SCA) Model

A SCA is required to distinguish the pulses induced by neutrons from those arising from gamma-ray interactions. A MATLAB SCA model was written that simply records those counts which are above the discrimination level. A discriminator dead time is an important parameter for the SCA and is a limiting factor establishing the system count rate. The output of the discriminator model is presented in Fig. 2, as a graph of the fraction of counts that are lost versus the true count rate, with voltage and charge sensitive preamplifiers. As can be seen from the figure, due to the dead time associated with the SCA, even with a voltage sensitive preamplifier, accurate dead time corrections are necessary to achieve large and accurate count rates.

3. Conclusions

Simulation techniques using TRIM, MATLAB, and PSpice can be useful tools for designing detector channels. Thus far TRIM, MATLAB and PSpice have been used to calculate the detector current output pulse for SiC semiconductor detectors and to model the pulses that propagate through potential detector channels. This
예비 해체 계획서 작성당시 임시비용에 관련한 법적 지침이 없기 때문에 해외 사례를 참고하여 가장 보수적으로 전체 해체 비용의 30%를 기장로 해체 과정에서의 임시비용으로 책정 함. 이에 따라 예비해체계획서의 2.2 비용을 다음과 붙임과 같이 개정함. (답변자 : KAERI, 진형곤, 042-868-4923)

model is useful for optimizing the detector and the resolution for application to neutron monitoring in the Generation IV power reactors.

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